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ABSTRACT

This report presents the findings of a study that examined the impact of compensatory education services on children's academic achievement in grades 1 to 6. Examination of data from the 1976-79 Sustaining Effects Study of Title I revealed the following major conclusions: (1) small positive gains in reading achievement are related to participation in Title I programs; (2) the estimated impact of Title I on children's achievement is sensitive to the definition of a control group; and (3) teacher judgment may be included in the selection and achievement process. The results of the analysis do not clarify the issue examined; results are dependent upon the formulation of the control group: one formulation used in the study showed positive results of Title I on achievement while the other three used generally showed no effects. There are the following possible explanations for this inconsistency: (1) the specification of the process by which students are selected for Title I services is critical; and (2) the measurement of program participation ignores variety in the services provided and in the intensity of participation. Data are presented on seven tables and figures. Two appendices provide the technical models used. A list of references is included. (BJV)

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An Analysis of the Impact of Title I on Reading and Math Achievement of Elementary School Aged Children

by

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Introduction

This report presents the findings of a study that examined the impact of compensatory education services on children's academic achievement in grades 1 to 6. More specifically, two general questions are addressed: 1) What is the effect of participation in Title I on students' reading and math achievement? and 2) What is the effect on students' achievement of attending a Title I school, but not participating in the program? Much research has centered on the effects of compensatory education on children's achievement; however, the findings have often been mixed. For example, a recent summary of evaluation research by Mullin and Summers (1983) concluded that the programs have small positive, short-term effects on the achievement of students. Further, they found that the programs are most beneficial in the early grades, and that there are no sustained effects of participation in compensatory education. Carter's (1984) overview of the results of the Sustaining Effects Study of Title I shows that when Title I students were compared to needy students--students judged to need services by teachers but not receiving such services--program participation had significant, positive effects on achievement. This was observed for students in grades 1 to 6 for mathematics achievement, and in grades 1 to 3 for reading achievement.

Before providing details of the current study and its results, the findings are highlighted:

- Small positive gains in reading achievement are related to participation in Title I programs, and
- The estimated impact of Title I on children's achievement is sensitive to the definition of a control group.

The remainder of this report is structured as follows. First, the data used in the analyses to estimate the impact of Title I are described. Second, the research design

is presented. Third, the results of the analyses are presented. Finally, implications of the findings are discussed.

The Data

To estimate the effects of Title I on students' achievement, data from the 1976-1979 Sustaining Effects Study of Title I (SES) are analyzed. The SES is a nationally representative sample of 80,000 elementary school aged students (see, for example, Hoepfner, Zagorski and Wellesch, 1977; Hemenway, Wang, Kenoyer, Hoepfner, Bear, and Smith, 1978). For a subset of 15,000 students it contains detailed information on parental and family characteristics (e.g., mother's educational attainment, family poverty status, number of siblings, race/ethnicity). For this study, only those students who were enrolled in schools that did not offer compensatory education services, offered only Title I services, or offered a mix of Title I and other compensatory education programs were analyzed. Students enrolled in schools that offer compensatory education programs not including Title I services were not included in the study.

Every student in the sample was administered a reading and math achievement test in the fall and spring of the first year of the survey. For a subset of students, achievement tests were administered each year for up to three years beginning in 1976. Students who were in grades 1 to 4 in the first year of the survey were administered up to six tests. Students in grade 5 were administered up to four achievement tests. Those in grade 6 in year 1 of the survey were administered at most two tests. For purposes of the analysis reported here, attention has been confined to the achievement growth of students between the fall and spring of the first year of the study.[1] Thus, only short term effects of Title I are examined. The achievement tests administered to the students were based on items taken from the CTBS. Test scores were converted to vertical scale score units and tests (below and at-level) defined as "best" by the

Systems Development Corporation (SDC) were used in the reported analyses. The vertical scale scores allow us to take test scores from alternative forms administered at different time periods and assess students' achievement growth. Thus, even though different tests may be administered to students in the fall and spring of each year, it is possible to translate the test scores into a common metric and analyze achievement growth from one test period to the next. In addition to collecting information from students and their parents, data were collected from principals and teachers in each student's school. In Table 1 univariate statistics for each variable used in the analyses are presented.

Research Design

Two general questions are addressed in the study. First, what is the effect of participating in a Title I program on students' achievement? Second, what is the effect of attending a Title I school on students' achievement? The analytic design used to address each of these questions is discussed in turn. In addition, the statistical model used to estimate the impact of Title I on achievement is described.

The Effects of Participation in Title I Programs on Students' Achievement. To estimate the effect of participation in Title I programs on students' achievement it is necessary to identify a relevant control group. However, there are alternative ways to define such a group. Ideally, as in a true experimental design, one would compare a randomly selected control group with a randomly selected treatment group. If students were randomly assigned to treatment groups (participation in a compensatory education program) and control groups (regular instruction), then the impact of compensatory education could be obtained by comparing the average achievement of students receiving services with those who did not. Under random assignment students in the two groups would be equivalent on average, except with respect to the provision of

services. Thus, the difference in the average achievement would correspond to the effect of participation in Title I.

However, the affect of Title I on students' achievement cannot be estimated using the idealized experimental design. In doing so, services would have to be withheld from students in need of such programs. Provided that services cannot be withheld from students, it becomes problematic to estimate the impact of Title I. Title I programs are designed for students who have low academic performance. Thus the treatment group and control groups will be made up of students with different achievement levels. There may be other differences as well between students in Title I programs and the nonparticipants. For example, students selected for Title I may have less ability to perform well in school than those not selected, and are more likely to come from economically disadvantaged families. Students who are selected for Title I may also, on average, be less motivated regarding school than their high achieving counterparts.

An alternative to using a randomized design is to compare Title I participants to students from Title I schools who are non-participants. The idea here is that students who receive Title I services presumably are more similar (for example, in terms of family background characteristics and achievement) to students who do not receive services but attend Title I schools than they are to students from schools that do not provide Title I programs. In addition, one could opt for a third approach when forming a control group: to compare Title I participants to a sample of students from schools where no compensatory education programs are offered.

To capture the nuances of each of the above alternatives for comparison, a three pronged strategy is used. Each prong focuses on an alternative "control group." The conjunction of the treatment group (those who participated in Title I) with each control group is referred to as Model 1, Model 2, and Model 3, respectively.

Before describing the control groups in greater detail, it should be noted that it is expected that Model 1--Title I participants contrasted with a hypothetical group of students selected for Title I, but not receiving services--will produce the most reasonable estimate of the impact of Title I on achievement. The results from the other models are shown to assess the sensitivity of the findings to the use of alternative control groups.

The first control group refers to a hypothetical group of students--those who were selected for Title I, but did not receive services. These students should be comparable to those who actually received Title I services, the only difference being receipt of services. In all other ways they should be the same. Thus, when the achievement of the participants is contrasted with nonparticipants hypothetically selected for the program, the results should approximate those obtained from a randomized experimental design. Before describing the other alternative control groups, it should be noted that in the SES sample, there are no students selected for Title I who had services withheld. Rather, this hypothetical group is formed by statistically equating the characteristics believed to influence academic growth of students who did and did not participate in Title I. A unique aspect of the method used here, is that we are able to take into account both observed characteristics of students such as family income and prior achievement and unobserved factors such as motivation and ability to achieve in school. Most previous analyses of Title I have only been able to partial out observed factors. Thus, the presence of differences in unobserved characteristics may still confound the effects of Title I on achievement. (See Technical Appendix 2 for a complete description of this procedure.)

Comparisons between students receiving Title I services and those in Title I schools and not receiving Title I (Model 2) provides the second measure of the effect of the program. Not only did these students not receive Title I services, but it is not

clear that they are necessarily eligible for services. A possible limitation of using non participants in Title I schools as a comparison group is that, on average, these students may have higher achievement scores and be more economically advantaged than those in the general population of students not receiving services. That is, many of the low achieving and disadvantaged students by definition will not be in the comparison group; they will be participants in Title I programs. Thus, the comparison groups will be made up of students who are more likely to perform at a higher level than those in the treatment group.

It is in response to this concern that the third alternative is employed. Use of the third comparison group in the analyses--students from non-compensatory education schools--may make it more likely that both high and low achieving students will be present. However, these schools in general will probably show higher achievement than those that do provide Title I programs. This is a function of the selection procedures used to target districts. Districts with high poverty concentration and, in turn, low achievement are most likely to receive Title I funds. Thus, it is more likely that their schools will be Title I schools. Therefore, those schools not receiving Title I on average, should have higher achievement than those receiving Title I.

Use of three control groups provides one with the ability to assess not only the impact of receipt of Title I services, but the sensitivity of the results to the kind of design employed. It is anticipated that the first control group--those hypothetically selected for services but who did not receive them--will provide the most valid results when contrasted with the achievement of participants. This follows since it is expected that students in this control group will be most like those in the treatment group and therefore will provide the ability to discount differences in achievement between the treatment and control group as being a product of differences in the kinds of students in the two groups.

The Effects of Attending a Title I School. To estimate the effect of attending a Title I school on students' achievement, the achievement of students in Title I schools, but not participating in Title I is compared with that of students in schools that do not provide Title I or other forms of compensatory education services. It is expected that students who do not participate in a compensatory education program will still benefit from having Title I in the school. More specifically, schools that offer Title I are presumed to provide a better learning environment than similar schools where there are no compensatory education services. For example, by pulling out low achieving students from classrooms for other services, teachers may be able to provide more suitable instruction to the high achieving students than would otherwise be possible when both high and low achieving students are present.

While this appears to be a relatively straightforward comparison, care must be used in the interpretation of the effects because of the confounding of other school level characteristics with the presence of Title I services in a school. For example, Title I schools have high poverty concentration in contrast to non-Title I schools. Thus, it is possible that some or all of the relationship between the presence of Title I in a school and a students' achievement is a function of other school level characteristics. Ideally, characteristics such as school socioeconomic status and race/ethnic mix would be held constant in the analysis. However, given the relatively small sample sizes that are encountered in the analysis and the large number of variables that are candidates to be included in the statistical models, it was decided that only family and student characteristics would be used as statistical controls in the analysis.

Model Specification

To model the impact of Title I on students' achievement, a statistical model composed of two basic processes is proposed: a selection process that sorts students

into Title I programs and an achievement process that generates the distribution of achievement test scores. These processes are captured by four statistical equations. It is hypothesized that the selection process as captured by a statistical equation shows the chances that individual students will be sorted into Title I programs (reading and math programs are treated separately). The achievement process links family and individual characteristics as well as pre-test (fall) achievement to post-test (spring) achievement. A separate achievement process is hypothesized for students in Title I programs; students in Title I schools, but not participating in Title I; and students in schools offering no compensatory education services. In the remainder of this section, a more detailed overview of the statistical model is provided. A technical discussion of the statistical model is presented in Technical Appendix 1. In addition, extensive discussions are presented in Barnow, Cain, and Goldberger (1980); Maddala (1984); and Murnane, Newstead and Olsen (1985).

The general model used to estimate the impact of Title I on students' achievement can be stated as follows (for the sake of simplicity, a subscript for each student has not been shown):

(1) $I^* = XD + e$

where $I = 1$ if $I^* > 0$ (participated in Title I)

$I = 0$ otherwise (did not participate in Title I, but in Title I school)

(2) $A_1 = XB_1 + u_1$

(3) $A_2 = XB_2 + u_2$

(4) $A_3 = XB_3 + u_3$

where equation (1) corresponds to the selection process (i.e., the relationship of family and individual characteristics to the probability of being selected for a Title I program), and equations (2) to (4) capture the achievement process that relates family and individual characteristics to a spring achievement test score in year 1 of the Sustaining

Effects Study. I* is an unobserved variable that reflects need for services and I is its observed counterpart. X represents a set of independent variables that affect both selection for Title I and students' achievement, D and the B's are conformable vectors of parameters to be estimated, and e and the u's correspond to random error terms. Equations (2) to (4) represent "potential achievement" of students in Title I (A_1); attending a Title I school, but not participating in Title I (A_2); and not in a Title I school (A_3), respectively. Depending on whether a student attends a Title I school and the outcome of the endogenous selection process on students in Title I services, students' achievement, A, will be generated by one of the following processes:

(5) $A = A_1$ if $I = 1$, (in Title I program)

(6) $A = A_2$ if $I = 0$, (did not participate in Title I program, but in Title I school), and

(7) $A = A_3$ if a student does not attend a Title I school.

Thus, the A's are observed conditional on the outcome of the endogenous selection process for students in Title I schools and the exogenous process related to attendance in a Title I school. Separate selection and achievement equations are estimated for reading and math and for students in grades 1 to 6. Participation in Title I refers only to participation during the grade enrolled in during the 1976-77 school year. For example, when estimating the impact of Title I on the achievement of students in grade 2, only data relevant to that grade is drawn on. Information about prior participation in Title I is not taken into account. Thus, the estimated effects of Title I on achievement in older grade cohorts of students may be confounded with earlier participation in compensatory education services.

The selection and achievement equations are estimated following a two-step estimation strategy outlined, for example, by Maddala (1983). Briefly, the selection equation is estimated as a probit model. Results from this equation are then

incorporated into the achievement equations. The achievement equations are estimated using ordinary least squares and standard errors of the estimates are derived following procedures suggested by Heckman (1979) and Greene (1981).

It is important to consider the variables that should be included in the statistical models. Previous research has shown that students' achievement is influenced by measures of material and intellectual resources in the home, students' gender, and prior achievement (see, for example, Jeneks et al., 1972; Myers et al., 1986). It is also expected that the chances of being selected for Title I are affected by the same variables. The following measures are used as indicators of family and individual characteristics thought to influence achievement and selection into Title I programs:

- o number of siblings;
- o mother's education;
- o family poverty status;
- o race/ethnicity; and
- o whether a language other than English is spoken in the home.

In addition to including these variables in the achievement and selection equations, teacher judgment regarding need of services is hypothesized to influence each of these processes. A recent analysis of the effects of Title I on achievement by Frontera (1985) was based on a specification similar to that proposed here. However, teacher judgment was hypothesized to only affect achievement through its relationship with selection into Title I. We believe this to be an improper specification of the achievement process. Teacher judgment of need for services is based on factors such as students' prior achievement and ability to benefit from the program and therefore, serves as a proxy for these measures, as well as others. By not including teacher judgment in the achievement equation implies that this variable does not directly affect achievement. While we believe that the exclusion of teacher judgment is inappropriate,

results are presented for both formulations of the achievement process. In doing so, the sensitivity of the effects of Title I to differences in model specification can be assessed.

In Figure 1, the basic relationships captured by the statistical model for students in Title I schools are illustrated. Clearly, the path (A) linking family background characteristics to participation in Title I and, in turn, the effect of participation on spring achievement (path C) does not exist for students not attending schools with compensatory education services. For students attending school with no compensatory education, only the effects represented by path B are estimated.

Once the statistical equations are estimated, the effects of Title I can be computed by contrasting predicted mean achievement of the Title I participants with the predicted mean achievement of students in each control group. (A detailed account of the derivation of the effects corresponding to Models 1 to 4 is presented in Technical Appendix 2.) Predicted mean achievement is based on the estimated parameters in the achievement equation (equation (2) to (4)) and predefined values of the exogenous variables. The predefined values in models 1 to 3 correspond to the average of the characteristics of Title I participants. For Model 4, the characteristics correspond to students in Title I schools, but not in Title I programs.

By using the characteristics of Title I participants for Model 1 to 3 and the students in Title I schools, but not participating in Title I for Model 4, observed differences in the composition of the treatment and control groups are held constant, thus nullifying differences in achievement produced by differences in group characteristics. The observed measures presumed to capture differences in composition are: pre-test achievement, number of siblings, mother's educational attainment, family poverty status, race/ethnic background, whether a language other than English is spoken in the home, and teacher judgment of need for services. As already noted,

both observed and unobserved characteristics of students are statistically held constant in the estimated effects of Title I derived from Model 1.

Results

In this section, results obtained when teacher judgment is presumed to directly influence selection and achievement are presented first. Second, results obtained when teacher judgment influences only the selection process and not achievement are discussed. Results for each of the four measures of Title I effects are presented so that they may be contrasted with one another. While the purpose of this paper is to report on the effects of Title I on students' reading and math achievement, a brief review of the findings pertaining to the parameter estimates in the selection and achievement equations is provided (estimates not shown).

In general, the results from the analysis that relates family and student characteristics to the chances of being in a Title I program (i.e., the selection equation) show as expected, that low achieving students and those judged as needing services are most likely to be in Title I. Further, the results show that students from disadvantaged families or who are non-white are somewhat more likely to participate in Title I programs than are students from advantaged backgrounds or are non-minority students.

The parameter estimates from the achievement equations show that for Title I participants, non-Title I participants in Title I schools, and students in schools with no compensatory education, family and student characteristics in to many instances affect the growth in achievement of the latter two groups, but not of Title I participants. Title I participants are a relatively homogeneous and small group of students. As a consequence, the lack of variation in family and student characteristics results in no generally observable effect on achievement growth between the fall and spring of the

academic year. On the other hand, family and student characteristics are observed to contribute to students' achievement growth for non-Title I students in Title I schools and for students in schools offering no compensatory education because of the greater variation found in those characteristics for these subgroups. The two most consistent variables affecting achievement are students' prior achievement and teacher judgment regarding need for services. Students with high fall achievement test scores have smaller gains in achievement than those with lower fall scores. Those students judged as needing services, as expected, have lower gains than similar students not judged as needing services.

Indirect evidence from the statistical analysis shows that among Title I participants, those who were most likely to be selected to receive services benefit most from the program. This finding must be considered with caution since none of the evidence was statistically significant; however, the pattern of results is consistent and therefore, suggestive. Among nonparticipants, those most likely to not receive services (e.g., those who scored high on the fall achievement test) performed at a higher level on the spring achievement tests than those who were less likely to receive regular instruction.

Teacher Judgment Included in the Selection and Achievement Processes

In Figures 2 and 3 estimates of the impact of Title I on students' achievement are presented. Numerical estimates and related t-statistics are provided in Table 2. Examination of the estimates for both reading and math achievement shows that Title I has no effect on achievement in many of the models, and negative effects in a number of others. However, the negative estimates of Title I tend to be statistically insignificant. These results show that when students participating in Title I reading or math programs are compared to students who did not participate in Title I (Model 2)

or did not attend a Title I school (Model 3) there are no differences in spring achievement scores, on average.

Only when Title I participants are contrasted with nonparticipants who have similar characteristics and the condition is imposed that the nonparticipants are selected for Title I, but do not receive services (Model 1), are positive and significant effects detected for reading achievement. On average, the estimates show that Title I reading participants score 50 points higher than similar students who were selected for Title I reading, but who did not receive services. While these appear to be relatively large effects, it must be noted that there is considerable variability around the estimates and the true effect may be much lower or higher. While none of the effects for math achievement are statistically significant, there is a tendency for participants to score about 14 points higher than nonparticipants. The pattern of Title I effects shows that for reading achievement, Title I appears to have a relatively large impact in grade 3 with somewhat smaller effects in later grades. Effects for math achievement are similar in magnitude across grade cohorts.

Another way to interpret the findings is to assess the relative impact of Title I on achievement. For example, taking students in grade 3, we find that if students had been selected for, but did not participate in Title I (i.e., the control group), then they would have an average reading achievement score of about 338 points. Thus, the effect of Title I (114 points) increases the average reading score 34 percent. In grade 2 where the smallest but still significant effect is found, Title I increases achievement 14 percent over what would be the predicted average for the control group.

When Title I participants are contrasted with students selected for Title I, but not receiving services (Model 1), the results conflict with those obtained from the alternative control groups (Models 2 and 3). These differences are at least partly a function of the kinds of students found in the treatment and control groups. That is,

student characteristics differ, and therefore obscure the impact of Title I on achievement. The research design used in the analysis controls for observed differences between the treatment group and the control groups. More specifically, the design takes out the effect of differences in composition concerning pre-test achievement, number of siblings, mother's educational attainment, family poverty status, race/ethnicity, whether a language other than English is spoken at home, and teacher judgment of need for services. All models take into account differences concerning these attributes; however, Model 1 also partials out differences in achievement related to unobserved (unmeasured) characteristics that may be confounded with the treatment effect of Title I. Potential unobserved variables are, for example, student's true ability and motivation. Models 2 to 4 do not control for unobserved differences in composition between the treatment and control groups, they only take into account differences in the exogenous variables.

To elaborate on the source of differences in results more fully, it is useful to recall the formulation of treatment and control groups for each model. Model 1 estimates are derived by considering two groups: Title I participants and students who were selected for Title I but who did not participate. Model 2 contrasts the same treatment group--Title I participants--with students in Title I schools who did not receive services. In Model 3, students participating in Title I are compared to similar students--at least in terms of the family and individual characteristics used in this study--who attended schools with no compensatory education programs.

A major distinction between the two control groups in Models 1 and 2 is that in Model 1 subjects in the control group were defined to have the characteristics of students who were selected, but who did not participate; while in Model 2 the control group refers to students not in Title I, nor those who would necessarily have been selected to participate. This means that the control group in Model 2 is comprised of

both students who need services and those who do not need services. Consequently, this group is not equivalent to the control group in Model 1 which is only comprised of those students who were hypothetically selected for Title I. A similar distinction between the Model 1 and 3 control groups exists. The Model 1 control group is again those who were selected, but who did not receive services while the Model 3 control group corresponds to those students in schools with no compensatory education. Not only did these students not participate in Title I, but on average it would be expected that they would come from somewhat more economically advantaged backgrounds and have higher achievement test scores, since they are in schools not targeted for Title I, state, or local compensatory education funds. As noted previously, differences in prior achievement and family economic status, for example, have been held constant in the analysis. However, there may be other components related to these characteristics that are not captured by the variables used here and thus, unobserved variables may contribute to the difference in mean achievement scores.

The final place in which Title I appears to influence achievement is Model 4. Here, the effect of attending a Title I school, but not participating in Title I is estimated. Only in grades 2 and 3 is an effect found for reading achievement. While Model 1 provided positive effects for Title I participation, the estimates under Model 4 are negative, suggesting that on average, students in Title I schools and not participating in Title I have lower achievement than similar students in schools offering no compensatory education, even when statistically holding constant family and individual characteristics.

Teacher Judgment Only in the Selection Process

In the discussion of model specification it was suggested that teacher judgment could influence both the chances of selection for Title I and achievement. In contrast, Frontera (1985) examined the same data, but excluded teacher judgment from the

achievement equation and generally found Title I to have no effect or negative effects on achievement. The first specification hypothesizes that teacher judgment of students' need for service influences achievement both indirectly through selection for Title I, and directly. In the specification used by Frontera, teacher judgment only affects achievement indirectly through the selection process. In the remainder of this section, findings based on two specifications are compared: 1) teacher judgment included in both the selection and achievement equations--Models 1 to 4, and 2) teacher judgment not included in the achievement equations, but only in the selection equation--Models 5 to 8. Figures 4 and 5 facilitate the comparison.

In general, the two specifications produce similar results at least in terms of the direction of the effect of Title I on reading achievement (see Figure 4). The one exception to the general pattern is found in the comparison of Models 1 and 5; that is, models where participants are contrasted with similar students selected for Title I, but who did not receive services. Examination of the results for Models 1 and 5 for reading achievement shows that when teacher judgment is allowed to have both indirect and direct effects on achievement--as already noted--a positive effect for Title I is found in many grades. On the other hand, when teacher judgment is hypothesized only to influence the selection process the opposite conclusion is reached: students who participate in Title I perform at a lower level than if they had not participated.

Turning to the results of Models 2 and 6, and Models 3 and 7, it is apparent that when teacher judgment only affects achievement indirectly through the selection process (i.e., teacher judgment is not included in the achievement equation), participation in Title I is related to low achievement. When teacher judgment is included and allowed to directly affect achievement, negative but insignificant estimates of the impact of Title I are found, thus providing minimal support for the contention

that Title I does not help low achieving children. Further, when the two formulations of the achievement process are used to estimate the effect of attending a Title I school, very small positive effects are detected when teacher judgment is not allowed to directly influence achievement, and negative effects are found when teacher judgment is allowed to have both direct and indirect effects on achievement.

In Figure 5, results from the two specifications for math achievement are presented. Here, as previously noted, when teacher judgment is allowed to directly influence achievement, Title I has no impact. In contrast, the alternative specification suggests that in a number of grades, participation in Title I is negatively related to children's achievement.

Implications

As noted in the introduction to this report, past evaluations of the effects of Title I, and more generally, compensatory education on achievement have found mixed results. In some instances, these programs have been found to have little if any effect, and in others it has been suggested that the programs hinder the educational development of the children. These mixed findings have usually been attributed to poor research designs. Since it is not possible to randomly assign students to "treatment" and "control" groups, the major criticism has been that analysts have not sufficiently controlled for all relevant variables on which the two groups differ.

The intent of the study undertaken here was to build on earlier research and to bring to bear new statistical techniques that provide greater ability to measure the effects of Title I. In so doing, three control groups were created. Despite this, the results from our analysis do not clarify the issue of whether Title I has a positive impact on students' achievement. It is observed that the results are dependent on the formulation of the control group. One formulation shows positive effects of Title I on achievement while the other three generally show no effects.

It is interesting to contrast these results with those reported by Carter (1984). Carter notes that when participants in Title I were compared with students judged by teachers as needing services, but not participating, Title I had positive effects. This result coincides with the finding of positive effects of Title I when participants were compared to students hypothetically selected for Title I, but who did not receive services. This similarity is intuitive, since it would be expected that students perceived to be needy by their teachers and not receiving services would be similar to those hypothetically selected for Title I, but not receiving services. The comparability in findings is encouraging because two different methodologies were used to arrive at this result and therefore the outcome is less likely to be method dependent.

Although positive effects were observed for this formulation, it is important to underscore that our results were mixed and dependent on the formulation of the control group. Despite the fact that statistical methods appropriate to the task at hand are used, it is difficult to state conclusively whether Title I has positive, negative, or no effects on students' achievement. There are two possible explanations for this inconsistency in results. First, the specification of the process by which students are selected for Title I services is critical in estimating the impact of Title I services on achievement. However, only a limited number of variables were hypothesized to affect selection and therefore, there may be others factors that should be taken into account. Second, the lack of consistency may lie in the measurement of program participation. This study, like others before it, examined the effects of participation in Title I, although students participating in Title I receive a variety of services and differ in their intensity of participation. In other words, "participation in Title I" is only a crude proxy for the "treatment" students received. It may be that it is difficult to assess the impact of Title I programs at this general level, and it is not

until program participation is examined with greater specificity that an assessment of effectiveness can be made.

Both of the above limitations suggest that a more fruitful approach to evaluating compensatory education programs is to focus on small scale data collection efforts where the measures used for selection are well understood, and it is possible to accurately measure services received by students. Knowledge of the actual selection mechanisms would permit analysts to obtain unbiased estimates of the effects of services in a straightforward manner (Goldberger, 1972). Further, it would be possible to begin to better understand what kinds of services are most beneficial.

Technical Appendix 1

The general model used to estimate the impact of Title I on students' achievement can be stated as follows:

(1.1) $I_i^* = X_iD + e_i$

where $I_i = 1$ if $I_i^* > 0$ (participant in Title I)

$I_i = 0$ otherwise (nonparticipant in Title I, but in Title I school)

(1.2) $A_{i1} = X_iB_1 + u_{i1}$

(1.3) $A_{i2} = X_iB_2 + u_{i2}$

(1.4) $A_{i3} = X_iB_3 + u_{i3}$

where equation (1.1) reflects the selection process for the ith student, equations (1.2) to (1.4) capture the achievement process, A_{ij} (j=1,..., 3) refers to spring achievement, X_i represents a set of independent variables that affect both selection for Title I and students' achievement, D and the B's are conformable vectors of parameters to be estimated, and e_i and the u_i's correspond to random error terms. Equations (1.2) to (1.4) represent "potential achievement" of students in Title I; not participating in Title I, but attending a Title I school; and not in a Title I school, respectively. By proposing three achievement equations we are hypothesizing that the achievement process is different for the Title I participants and nonparticipants in Title I schools. Depending on the outcome of the selection process, students' achievement will be generated by one of the following processes:

(1.5) $A_i = A_{i1}$ if $I_i = 1$,

(1.6) $A_i = A_{i2}$ if $I_i = 0$, and

(1.7) $A_i = A_{i3}$ if a student does not attend a Title I school.

Thus, the A_i are observed conditional on the outcome of the selection process. Implicit in the setup of the design are two selection processes. First is whether a student is in a school that offers Title I. Whether a student is in a Title I school or

a school offering no compensatory education is treated as a function of an exogenous process. The second selection process focuses on the sorting of students into Title I programs. Selection into a specific program is based on a number of factors such as achievement test scores and teacher judgment. This sorting mechanism is treated as endogenous to the model.

Estimation of the achievement equations (1.5) and (1.6) requires that the possible correlation between the error in the selection equation and the achievement equation be taken into account. It is assumed that $E(u_{ij},e_i)$ is a linear function of e_i such that the marginal distributions of u_{ij} and e_i have mean 0, and var (u_{ij}) = $sigma_j$ and $var(e_i) = 1$.

Taking equation (1.1) into account, it can be shown that equations (1.5) and (1.6) can be specified as follows:

$A_{i1} = X_{i1}$ B1 + ui_1 when $I_i^* > 0 <=> e_i > -X_i D$.

$A_{i2} = X_{i2} B_2 + ui_2$ when $I_i^* <= 0 <=> e_i <= -X_i D$.

It is usually proposed that $E(A_{ij}|X_{ij}) = X_{ij} B_j$ under the assumption that $E(u_{ij}|X_{ij}, I^*) = 0$. However, when the error in the selection equation is correlated with the error in the achievement equation, this is no longer the case. By allowing for correlated errors and taking expectations of the random variables in equations (1.5) and (1.6) the following equations can be derived:

(1.8) $E(A_{i1}|X_{i1}, e_i > -X_i D) = X_{i1} B_1 + E(_{i1}|e_i > -X_{i1} D)$ and

(1.9) $E(A_{i2}|X_{i2}, e_i < = -X_i D) = X_{i2} B_2 + E(u_{i2}|e_i < = -X_{i2} D)$.

Equations (1.8) and (1.9) show that an additional variable must be added to the original specification when analyzing the achievement processes as defined by the endogenous selection mechanism. It can be shown that when the error term for the achievement equations (u_{i1} and u_{i2}) are linearly related to the error in the selection equation (e_i)

and this error is normally distributed, the conditional expectations of the error terms in equations (1.8) and (1.9) are:

(1.10) $\text{cov}(e_i,u_{i1})\ L_{i1} = \text{cov}(e_i,u_{i1})(f(-X_i\ D)/(1 - F(-X_i\ D))$ and

(1.11) $\text{cov}(e_i,u_{i2})\ L_{i2} = \text{cov}(e_i,u_{i2})\ (-f(-X_i\ D)/F(-X_i\ D))$

where f(.) denotes the density function for a normally distributed random variable and F(.) corresponds to the cumulative density function of a normally distributed random variable. The denominator of equation (1.9) equals the probability of student i being selected into a Title I reading (math) program. Thus, as the probability of selection increases, the variable L_{i1} decreases monotonically. For L_{i2} it is apparent that as the probability of not participating in a Title I program increases, there is a corresponding decrease.

Substituting equations (1.10) and (1.11) into (1.8) and (1.9) produces

(1.11) $E(A_{i1}|X_{i1},\ e_i > -X_i\ D) = X_{i1}\ B_1 + \text{cov}(e_i,u_{i1})(f(-X_i\ D)/(1-F(-X_i\ D))$ and

(1.12) $E(A_{i2}|X_{i2},\ e_i <= -X_i\ D) = X_{i2}\ B_2 + \text{cov}(e_i,u_{i2})\ (-f(-X_i\ D)/F(-X_i\ D))$.

Contrasting equations (1.5) and (1.6) with equations (1.8) and (1.9) shows that if the additional covariates are not included in the equations, then biased estimates of the coefficients in B_j are obtained. In turn, this would produce biased estimates of the impact of Title I. This results from the specification error incurred by not including all relevant variables in the equations. Thus, the correct specification of equations (1.5) and (1.6) in the presence of the endogenous selection process takes the following form:

(1.13) $A_{i1} = X_{i1}\ B_1 + C_1(f(-X_iD)/(1-F(-X_iD)) + w_{i1}$

(1.14) $A_{i2} = X_{i2}\ B_2 + C_2\ (-f(-X_iD)/F(-X_iD)) + w_{i2}$

where C_1 and C_2 are merely symbols for the covariances among the respective errors as shown in equations (1.11) and (1.12).

Estimation of the parameters in equations (1.5) and (1.6) can be undertaken by first obtaining estimates for D by using a probit maximum likelihood procedure. After estimating D, the variables capturing the conditional expectations of the errors are constructed and included as independent variables in a regression equation. Once the auxiliary variable has been added to the equation, ordinary least squares can be applied. Consistent estimates of the parameters will result from such a procedure. Estimation of the variance-covariance matrix of each B and $cov(e_i,u_{ij})$ is undertaken following procedures developed by Heckman (1979) and Greene (1981).

In the case of the achievement equation for students in schools with no compensatory education services, it is not necessary to be concerned with the endogenous sorting mechanism and therefore the achievement equation can be estimated with ordinary least squares.

Technical Appendix 2

After obtaining estimates of the parameters, the four measures of the impact of Title I can be calculated.[2] Each of these is shown in detail below.

Impact of Participating in a Title I Program. Three estimates of the effect of Title I participation on students' achievement are derived in this study. Separate measures are obtained for reading and math achievement for grade cohorts 1 to 6.

The first estimate of the effect of Title I is derived by contrasting the reading (math) achievement of students who participated in Title I reading (math) programs with that for students who "were selected for Title I reading (math) but had services withheld." Clearly, the latter group does not exist in the population. However, mathematically such a group of students can be constructed. To do so, the following expression is formed:

$$(2.1)\quad E(A_{i2}|I=1) = E(A_{i2}|e_i>-X_iD)$$
$$= X_{i2}B_2 + \text{cov}(e_i,u_{i2})\,(f(-X_i D)/(1 - F(-X_i D)).$$

Equation (2.1) corresponds to the achievement of nonparticipants selected for Title I (I=1). Subtracting equation (2.1) from (1.11) produces the following result:

$$(2.2)\quad E(A_{i1}|I=1) - E(A_{i2}|I=1) = X(B_2 - B_1) + (\text{cov}(e_i,u_2) -$$
$$\text{cov}\,(e_i,u_{i1}))\,(f(-X_iD)/(1 - F(-X_iD)).$$

It can be seen in equation (2.2) that both observed differences $X(B_2-B_1)$ and unobserved effects $(((\text{cov}(e_i,u_{i2}) - \text{cov}(e_i,u_{i1})\,(f(-X_iD)/(1-F(-X_iD)))$ are taken into account in the computation of the effects of Title I on achievement. The second measure compares the reading (math) achievement of students that participated in Title I reading (math) programs with students who attended Title I schools, but did not participate and would not necessarily have been selected for Title I reading (math) programs. This comparison is undertaken using the following specification:

$$(2.3)\quad A_{i1} - A_{i2} = X_{i1}(B_1 - B_2).$$

The third estimate of the effect of participation in Title I reading (math) programs is derived by comparing the program participants with students who attend schools with no compensatory education. That is,

(2.4) $A_{i1} - A_{i3} = X_{i1} (B_1 - B_3)$.

For the comparisons stated in equations (2.2), (2.3) and (2.4) X_{i1} is assigned the average characteristics of students who received Title I services.

Impact of Attending a Title I School. To estimate the impact of attending a Title I school, reading (math) achievement of students attending Title I schools, but not participating in Title I reading (math) programs is compared with that of students attending schools with no compensatory education services. More specifically, the following comparison is made:

(2.5) $A_{i2} - A_{i3} = X_2 (B_2 - B_3)$

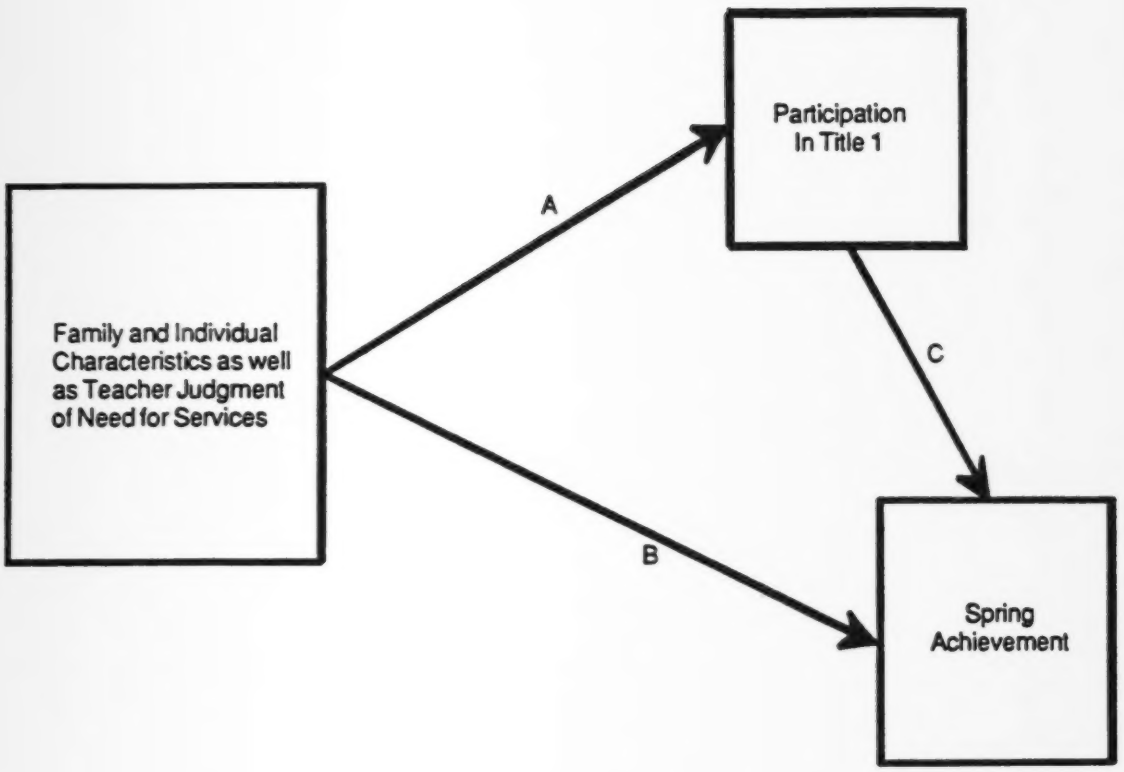
where the composition of the two types of schools has been standardized (i.e., set equal to that of the average non Title I participant in a Title I school).

ENDNOTES

1. Growth in students' achievement is represented in the statistical models estimated here by specifying that earlier achievement (fall) influences latter achievement (spring). That is, a students spring achievement is hypothesized to be affected by their fall achievement test score as well as other family and individual characteristics.

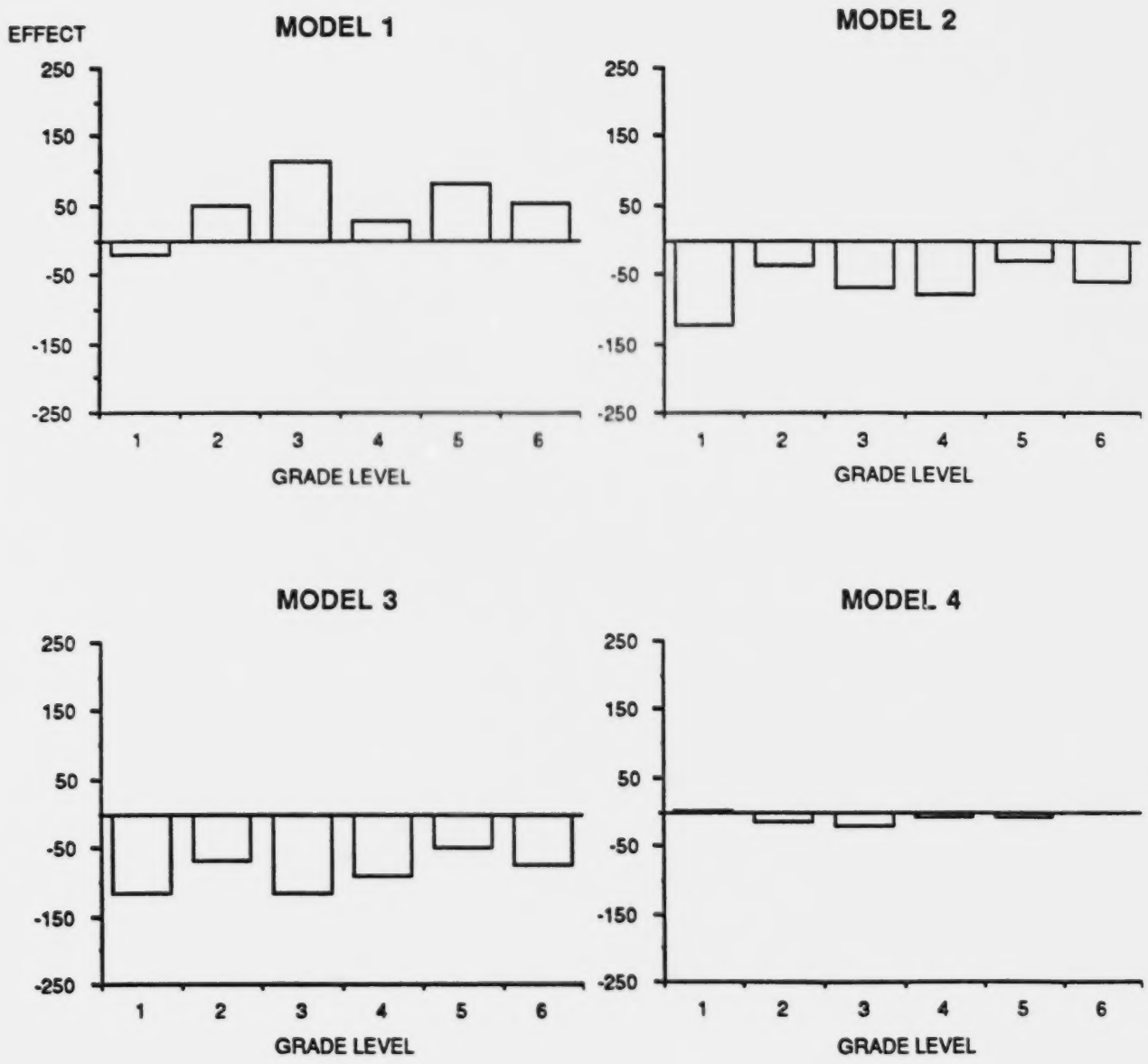
2. Statistically to test for differences between the average achievement of the treatment and control groups we compute simple t-statistics. To compute the t-statistic we need both a measure of the difference in average achievement which is provided in our comparisons, and an estimate of the standard error of the difference in means. The general expression for the standard error of the difference in predicted achievement of two groups is $(X(V(B_k) + V(B_1))X')$ where X corresponds to a vector of preassigned values that refer to the variables in the achievement equation, and $V(B_m)$ for m=k,1 refers to the variance-covariance matrix of the estimated parameters in the achievement equations. For the analyses reported here, the variance-covariance matrices corrected for the addition of the predicted sample selection terms in the achievement equations are used.

FIGURE 1. CONCEPTUAL MODEL



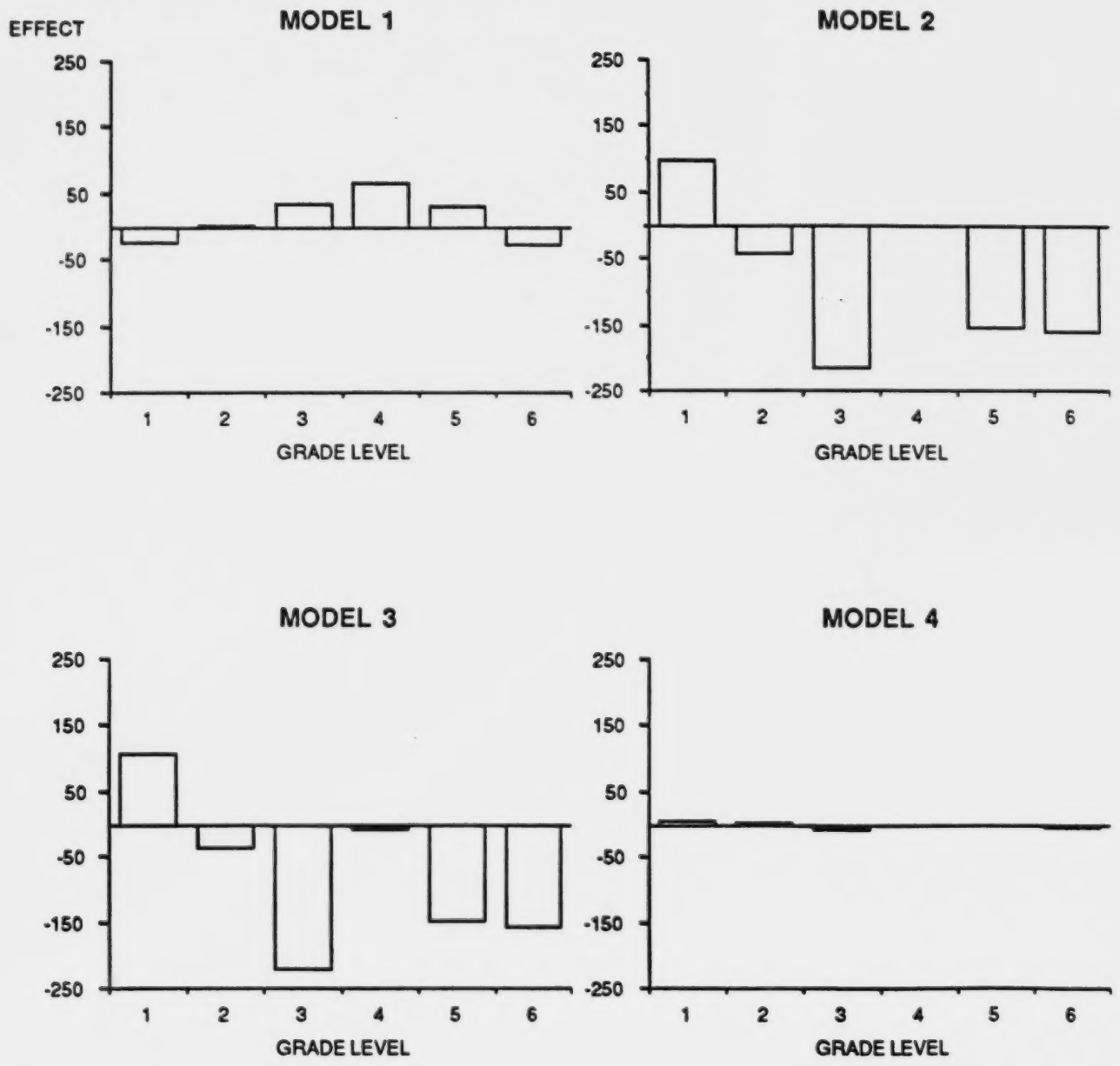
Note: A and C paths only exist for students in Title 1 schools.

FIGURE 2. ESTIMATED EFFECTS OF TITLE 1 ON READING ACHIEVEMENT



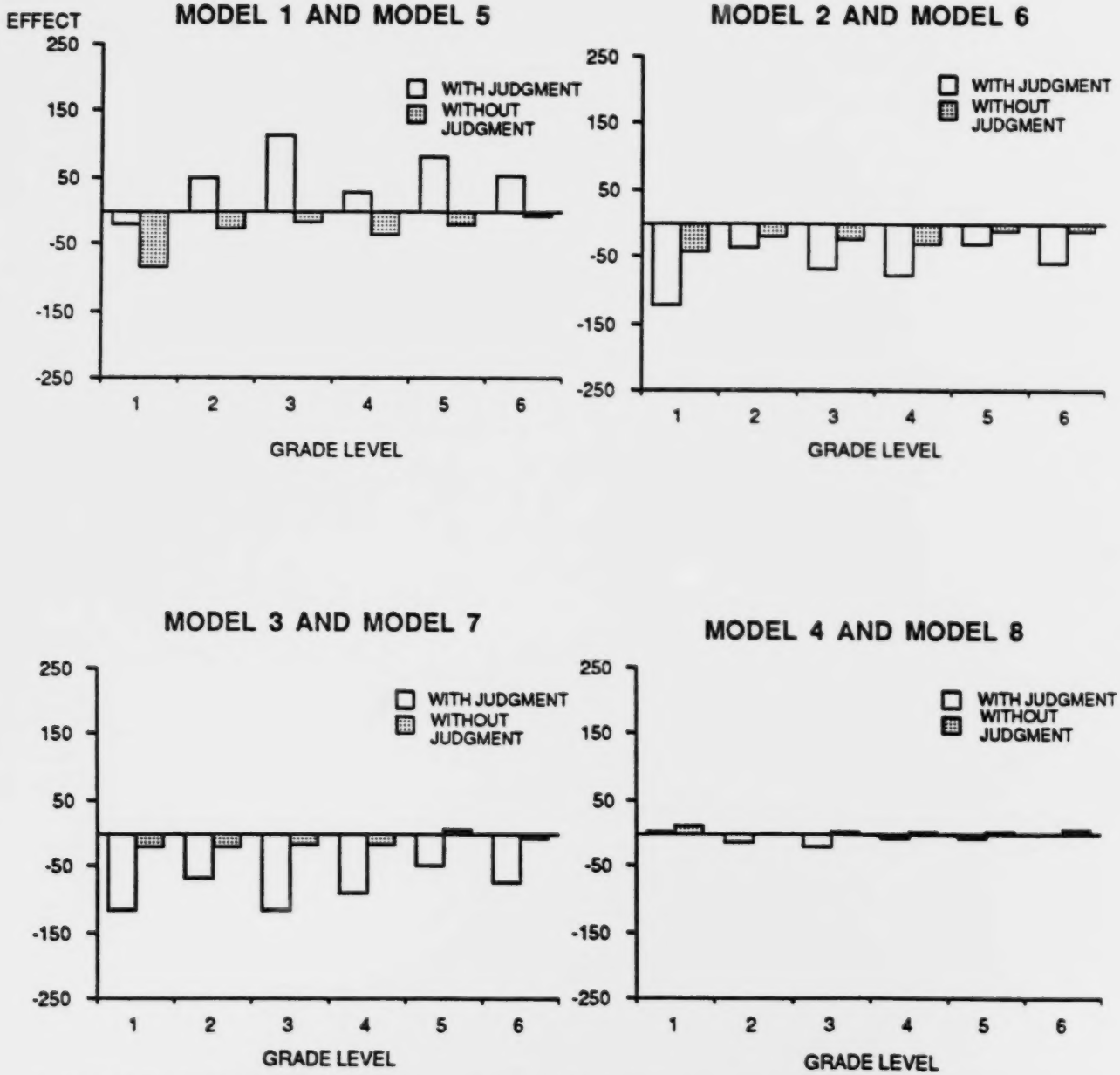
Note: MODEL 1 refers to the difference in achievement between participants in Title 1 and the hypothetical group of students selected for Title 1, but who did not receive services; MODEL 2 refers to the difference in achievement between participants in Title 1 and those students in Title 1 schools, but not participating in Title 1; MODEL 3 refers to the difference in achievement between participants in in Title 1 and students in schools offering no compensatory education services; and MODEL 4 refers to the difference in achievement between students in Title 1 schools and not participating and those in schools offering no compensatory education services.

FIGURE 3. ESTIMATED EFFECTS OF TITLE 1 ON MATH ACHIEVEMENT



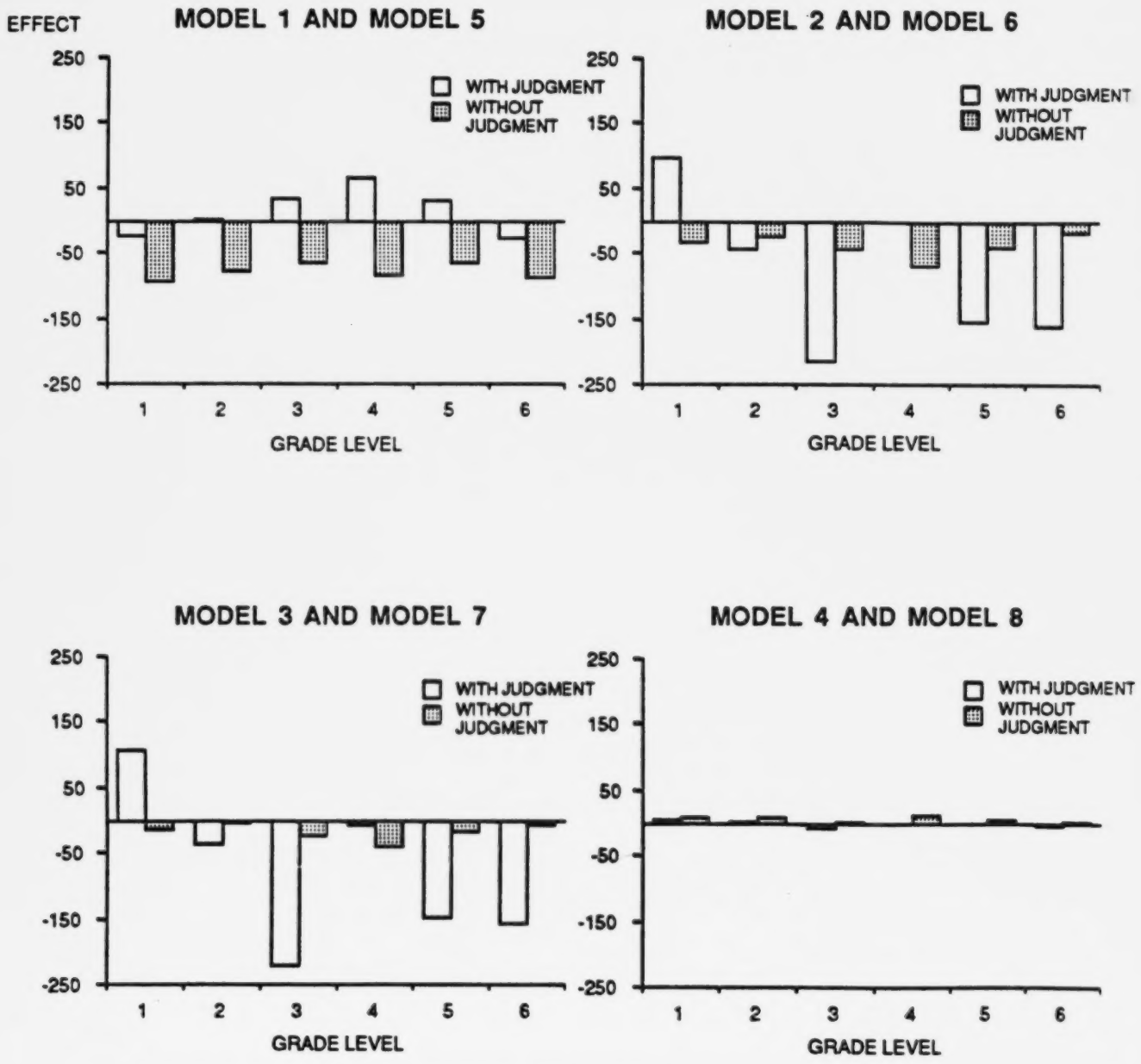
Note: MODEL 1 refers to the difference in achievement between participants in Title 1 and the hypothetical group of students selected for Title 1, but who did not receive services; MODEL 2 refers to the difference in achievement between participants in Title 1 and those students in Title 1 schools, but not participating in Title 1; MODEL 3 refers to the difference in achievement between participants in in Title 1 and students in schools offering no compensatory education services; and MODEL 4 refers to the difference in achievement between students in Title 1 schools and not participating and those in schools offering no compensatory education services.

FIGURE 4. COMPARISON OF EFFECTS WITH AND WITHOUT TEACHER JUDGMENT INCLUDED IN THE READING ACHIEVEMENT EQUATIONS



Note: MODEL 1 and 5 refer to the difference in achievement between participants in Title 1 and the hypothetical group of students selected for Title 1, but who did not receive services; MODEL 2 and 6 refer to the difference in achievement between participants in Title 1 and those students in Title 1 schools, but not participating in Title 1; MODEL 3 and 7 refer to the difference in achievement between participants in in Title 1 and students in schools offering no compensatory education services; and MODEL 4 and 8 refer to the difference in achievement between students in Title 1 schools and not participating and those in schools offering no compensatory education services.

FIGURE 5. COMPARISON OF EFFECTS WITH AND WITHOUT TEACHER JUDGMENT INCLUDED IN THE MATH ACHIEVEMENT EQUATIONS



Note: MODEL 1 and 5 refer to the difference in achievement between participants in Title 1 and the hypothetical group of students selected for Title 1, but who did not receive services; MODEL 2 and 6 refer to the difference in achievement between participants in Title 1 and those students in Title 1 schools, but not participating in Title 1; MODEL 3 and 7 refer to the difference in achievement between participants in in Title 1 and students in schools offering no compensatory education services; and MODEL 4 and 8 refer to the difference in achievement between students in Title 1 schools and not participating and those in schools offering no compensatory education services.

Table 1
Univariate Statistics

Variable	Grade 1						Grade 2					
	Title 1 Reading Participants		Non Title 1 Reading Participants		Students in Schools offering no Compensatory Ed. Programs		Title 1 Reading Participants		Non Title 1 Reading Participants		Students in Schools offering no Compensatory Ed. Programs	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Number of Siblings	2.49	1.86	1.70	1.26	1.84	1.48	2.45	1.94	1.97	1.45	1.82	1.38
Mother's Educational Attainment	9.72	3.49	11.64	3.05	12.33	3.16	10.02	3.59	11.60	3.08	12.33	2.38
Family Poverty Status	0.40	0.49	0.14	0.35	0.12	0.33	0.28	0.45	0.16	0.37	0.12	0.33
Black	0.26	0.44	0.14	0.35	0.16	0.37	0.18	0.38	0.14	0.35	0.17	0.38
Hispanic	0.11	0.32	0.05	0.22	0.03	0.18	0.08	0.27	0.06	0.24	0.02	0.13
Student's Gender	0.44	0.50	0.52	0.50	0.45	0.50	0.37	0.48	0.52	0.50	0.47	0.50
Language other than English spoken at home	0.16	0.37	0.10	0.30	0.09	0.29	0.13	0.33	0.11	0.32	0.08	0.27
Teacher judgement of need for Reading Services	0.78	0.41	0.20	0.40	0.18	0.39	0.88	0.32	0.22	0.42	0.24	0.43
Fall Reading Achievement	322.26	29.33	349.69	30.98	347.08	33.24	384.24	35.232	429.75	45.81	420.45	48.18
Spring Reading Achievement	379.98	36.67	419.93	43.44	416.59	45.04	426.22	43.68	472.92	51.03	470.19	51.35
N	222		1,038		221		273		904		188	

Table 1
Univariate Statistics

Variable	Grade 3						Grade 4					
	Title 1 Reading Participants		Non Title 1 Reading Participants		Students in Schools offering no Compensatory Ed. Programs		Title 1 Reading Participants		Non Title 1 Reading Participants		Students in Schools offering no Compensatory Ed. Programs	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Number of Siblings	2.33	1.72	1.98	1.58	1.88	1.41	2.36	1.65	2.07	1.48	1.48	1.05
Mother's Educational Attainment	10.88	3.57	11.47	3.21	12.00	2.96	9.96	3.70	11.26	3.10	12.50	2.79
Family Poverty Status	0.34	0.47	0.18	0.38	0.09	0.29	0.33	0.47	0.18	0.38	0.09	0.28
Black	0.27	0.45	0.14	0.34	0.11	0.31	0.26	0.44	0.14	0.34	0.13	0.34
Hispanic	0.11	0.32	0.06	0.25	0.02	0.15	0.10	0.30	0.06	0.23	0.02	0.12
Student's Gender	0.44	0.50	0.50	0.50	0.48	0.50	0.37	0.49	0.55	0.50	0.47	0.50
Language other than English spoken at home	0.17	0.37	0.11	0.31	0.08	0.27	0.15	0.36	0.10	0.30	0.10	0.30
Teacher judgement of need for Reading Services	0.84	0.37	0.19	0.39	0.22	0.42	0.84	0.36	0.20	0.40	0.25	0.43
Fall Reading Achievement	418.34	37.85	475.72	51.18	475.58	53.23	447.47	45.19	508.87	53.78	504.36	60.53
Spring Reading Achievement	452.08	40.48	508.28	50.99	507.88	56.82	476.60	47.85	537.12	55.73	537.75	63.89
N	257		850		220		219		851		195	

Table 1
Univariate Statistics

Variable	Grade 5						Grade 6					
	Title 1 Reading Participants		Non Title 1 Reading Participants		Students in Schools offering no Compensatory Ed. Programs		Title 1 Reading Participants		Non Title 1 Reading Participants		Students in Schools offering no Compensatory Ed. Programs	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Number of Siblings	2.51	1.79	2.09	1.61	1.77	1.10	2.36	1.52	1.94	1.46	2.00	1.53
Mother's Educational Attainment	9.71	3.66	11.21	3.37	12.60	2.51	9.43	3.67	11.25	3.27	11.89	2.58
Family Poverty Status	0.28	0.45	0.16	0.37	0.08	0.27	0.32	0.47	0.15	0.36	0.10	0.30
Black	0.26	0.44	0.13	0.33	0.12	0.33	0.23	0.42	0.11	0.31	0.09	0.29
Hispanic	0.13	0.33	0.07	0.26	0.03	0.18	0.13	0.33	0.05	0.22	0.03	0.16
Student's Gender	0.45	0.50	0.50	0.50	0.41	0.49	0.43	0.50	0.48	0.50	0.53	0.50
Language other than English spoken at home	0.17	0.38	0.12	0.32	0.72	0.26	0.16	0.37	0.10	0.30	0.05	0.21
Teacher judgement of need for Reading Services	0.86	0.35	0.20	0.40	0.18	0.38	0.81	0.40	0.18	0.38	0.21	0.41
Fall Reading Achievement	477.78	47.09	543.82	62.28	544.93	62.42	493.91	54.94	574.13	66.64	561.28	68.48
Spring Reading Achievement	504.78	53.58	570.29	65.17	570.31	73.01	520.63	50.34	599.19	67.87	583.01	68.82
N	222		912		222		166		941		297	

Table 1
Univariate Statistics

Variable	Grade 1						Grade 2					
	Title 1 Math Participants		Non Title 1 Math Participants		Students in Schools offering no Compensatory Ed. Programs		Title 1 Math Participants		Non Title 1 Math Participants		Students in Schools offering no Compensatory Ed. Programs	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Number of Siblings	2.32	1.96	1.79	1.35	1.84	1.48	2.32	1.48	2.04	1.58	1.82	1.38
Mother's Educational Attainment	9.92	3.13	11.44	3.17	12.38	3.15	9.86	0.97	11.41	3.13	12.33	2.38
Family Poverty Status	0.47	0.50	0.16	0.37	0.12	0.32	0.34	0.48	0.17	0.38	0.12	0.33
Black	0.49	0.50	0.14	0.34	0.15	0.36	0.28	0.45	0.13	0.34	0.17	0.38
Hispanic	0.12	0.32	0.05	0.23	0.03	0.18	0.16	0.37	0.06	0.23	0.02	0.13
Student's Gender	0.45	0.50	0.51	0.50	0.44	0.50	0.43	0.50	0.49	0.50	0.47	0.50
Language other than English spoken at home	0.17	0.37	0.10	0.31	0.09	0.28	0.18	0.39	0.11	0.31	0.08	0.27
Teacher's judgement of need for Math Services	0.70	0.46	0.17	0.38	0.10	0.31	0.76	0.43	0.21	0.41	0.2	0.40
Fall Math Achievement	309.62	33.83	334.53	33.27	337.37	36.41	365.24	38.50	396.22	44.01	395.51	46.21
Spring Math Achievement	387.34	37.73	397.00	44.73	396.14	49.55	417.21	43.91	453.19	49.06	450.53	52.65
N	102		1,155		222		126		1,043		188	

Table 1
Univariate Statistics

Variable	Grade 3						Grade 4					
	Title 1 Math Participants		Non Title 1 Math Participants		Students in Schools offering no Compensatory Ed. Programs		Title 1 Math Participants		Non Title 1 Math Participants		Students in Schools offering no Compensatory Ed. Programs	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Number of Siblings	2.47	1.68	2.00	1.53	1.86	1.41	2.41	1.53	2.09	1.51	1.48	1.05
Mother's Educational Attainment	9.86	3.58	11.34	3.28	12.00	2.96	10.09	3.36	11.13	3.25	12.50	2.79
Family Poverty Status	0.42	0.50	0.19	0.39	0.09	0.29	0.40	0.50	0.18	0.38	0.09	0.28
Black	0.44	0.50	0.13	0.33	0.11	0.31	0.41	0.49	0.13	0.33	0.13	0.34
Hispanic	0.13	0.33	0.07	0.25	0.02	0.15	0.09	0.29	0.06	0.24	0.02	0.12
Student's Gender	0.53	0.50	0.47	0.50	0.46	0.50	0.53	0.50	0.51	0.50	0.47	0.50
Language other than English spoken at home	0.18	0.39	0.11	0.32	0.08	0.27	0.14	0.35	0.11	0.31	0.10	0.30
Teacher's Judgement of need for Math Services	0.82	0.39	0.17	0.38	0.20	0.40	0.72	0.45	0.20	0.40	0.14	0.35
Fall Math Achievement	485.61	39.38	451.02	46.57	451.71	46.98	455.30	45.68	504.58	56.60	503.86	56.73
Spring Math Achievement	459.36	49.46	509.42	54.28	513.3	60.05	510.29	54.33	556.70	59.18	555.75	62.04
N	144		962		220		138		932		195	

Table 1
Univariate Statistics

Variable	Grade 5						Grade 6					
	Title 1 Math Participants		Non Title 1 Math Participants		Students in Schools offering no Compensatory Ed. Programs		Title 1 Math Participants		Non Title 1 Math Participants		Students in Schools offering no Compensatory Ed. Programs	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Number of Siblings	2.30	1.63	2.16	1.65	1.77	1.10	2.48	1.48	1.96	1.47	2.01	1.54
Mother's Educational Attainment	9.43	3.97	11.12	3.36	12.60	2.51	9.59	3.88	11.08	3.33	11.91	2.54
Family Poverty Status	0.25	0.44	0.18	0.38	0.08	0.27	0.35	0.48	0.16	0.37	0.10	0.30
Black	0.35	0.48	0.13	0.33	0.12	0.33	0.32	0.47	0.11	0.31	0.09	0.28
Hispanic	0.12	0.33	0.08	0.27	0.03	0.18	0.07	0.26	0.06	0.24	0.03	0.16
Student's Gender	0.35	0.49	0.50	0.50	0.40	0.50	0.41	0.50	0.47	0.50	0.53	0.50
Language other than English spoken at home	0.18	0.39	0.12	0.32	0.07	0.26	0.16	0.36	0.11	0.31	0.05	0.21
Teacher's judgement of need for Math Services	0.82	0.39	0.19	0.40	0.17	0.37	0.74	0.44	0.19	0.39	0.17	0.38
Fall Math Achievement	496.54	51.82	552.64	63.17	560.55	62.48	534.80	42.23	591.85	69.72	589.26	66.16
Spring Math Achievement	548.34	57.07	597.80	70.96	611.52	75.89	567.65	45.33	629.67	77.04	632.02	80.29
N	130		1,003		222		82		1,021		296	

TABLE 2

Estimates of the Effect of Title 1 on Reading and Math Achievement

	Reading Achievement								Math Achievement							
	Model 1[1/]		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
Grade	est.[2/]	t[3/]	est.	t	est.	t	est.	t	est.	t	est.	t	est.	t	est.	t
1	-20.1	-.6	-121.4	-1.1	-114.1	-1.1	3.9	.8	-23.8	-.5	97.2	.4	106.7	.5	6.8	1.6
2	52.2	2.0	- 33.5	- .5	- 65.8	- .9	-11.9	-2.3	2.9	.0	- 41.3	-.1	- 34.4	- .1	3.4	.5
3	113.6	3.1	- 65.9	- .5	-114.9	- .9	-19.1	-3.1	34.6	1.0	-211.9	-.9	-220.7	-1.0	-6.6	-1.4
4	28.2	1.2	- 77.5	- .9	- 89.5	-1.0	- 5.9	-1.3	65.8	1.5	1.4	.1	- 5.6	- .0	- .9	- .1
5	84.0	2.6	- 28.4	- .3	- 48.5	- .5	- 7.1	-1.4	31.9	.6	-152.1	-.5	-147.2	- .5	-1.5	- .2
6	54.0	2.5	- 57.1	- .7	- 73.5	- .9	- 1.5	- .5	-27.0	-.4	-159.5	-.3	-154.5	- .3	-1.6	- .3

1/ The models are described in the text.

2/ Estimated effect of Title 1 on students' achievement.

3/ t-statistic associated with estimated effect. A t > 1.96 is significant at .05 level.

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